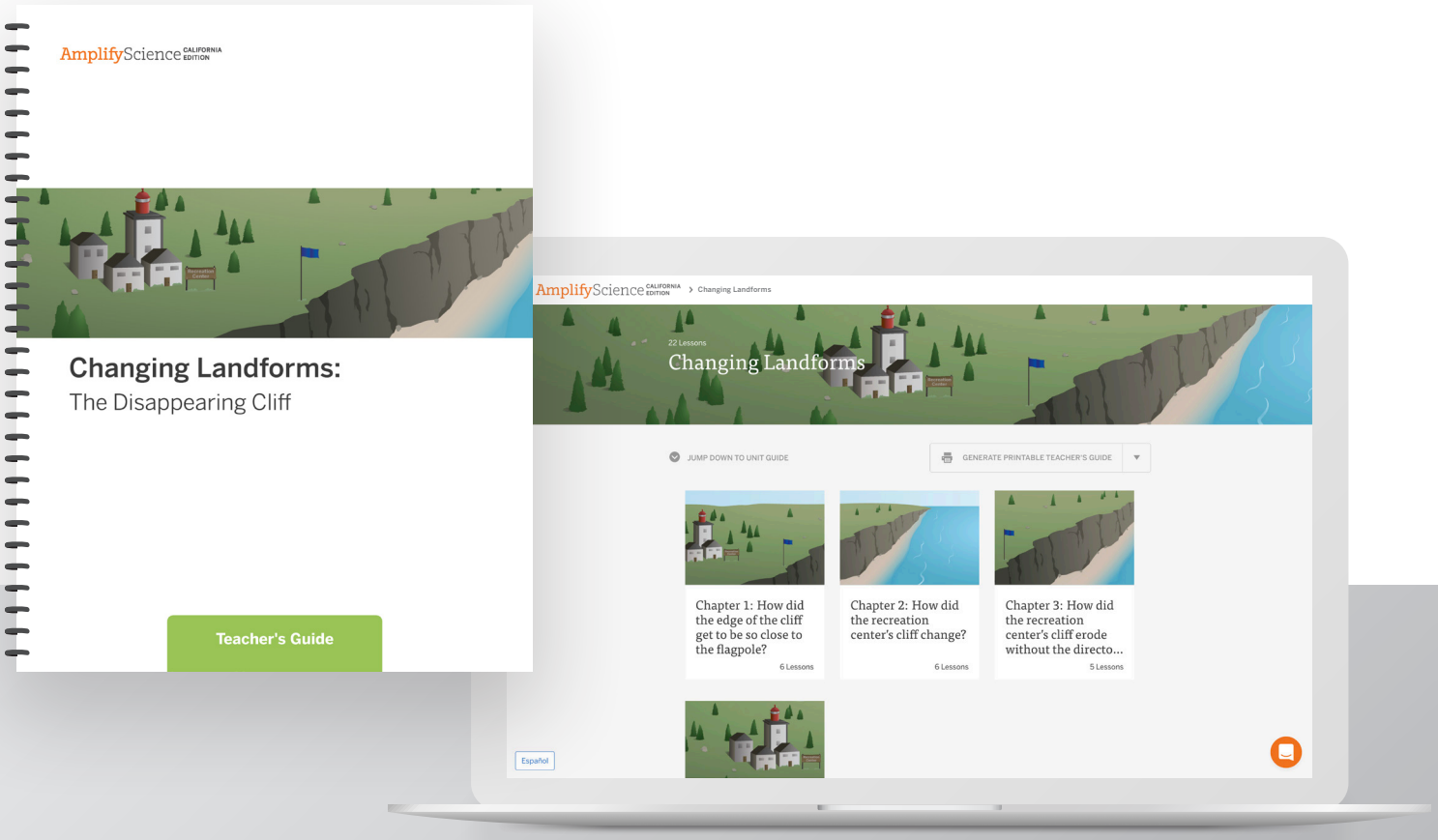
Amplify Science
CALIFORNIA

Grade 2

UNIT GUIDE

Changing Landforms



Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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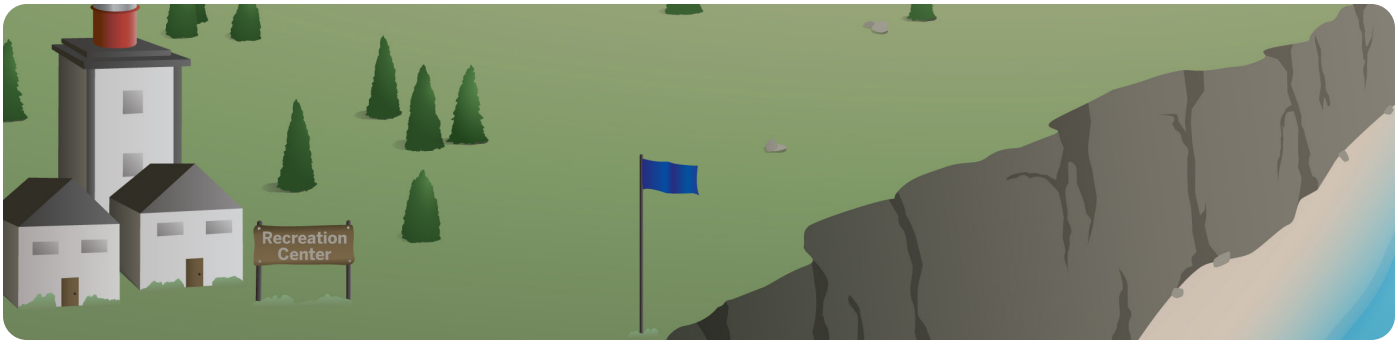


Welcome to Changing Landforms

Many people hold onto ideas about the stability of Earth and its features and materials, even after being taught otherwise, largely because the idea that wind and water can change rock is hard to believe. Students commonly think that rocks and sand have always existed in their present forms and that Earth's landforms do not change. To help confront such preexisting notions, Amplify Science California focuses on the idea that Earth's materials and features—even materials as hard as rock—change due to erosion. Repeated opportunities for students to observe evidence of erosion in the models, photos, and maps they use help students understand that Earth and its features can and do change.

> Unlike a typical curriculum, Amplify Science California anchors learning by inviting students to take on the role of scientists and engineers.

In this unit, students take on the role of geologists. Their job is to help the director of the fictional Oceanside Recreation Center figure out why a nearby cliff has collapsed. Research reveals that the distance between the Recreation Center's flagpole and the edge of the cliff have changed over time, but why? Based on what they learn about erosion, they must advise the director on whether it is safe to keep the center open even though the cliff is changing.

Unit Type: Modeling

Student Role: Geologists

Phenomenon: The cliff that Oceanside Recreation Center is situated on appears to be receding over time.

Core Concept: Understanding how wind and water can cause changes to landforms

Target Performance Expectations:

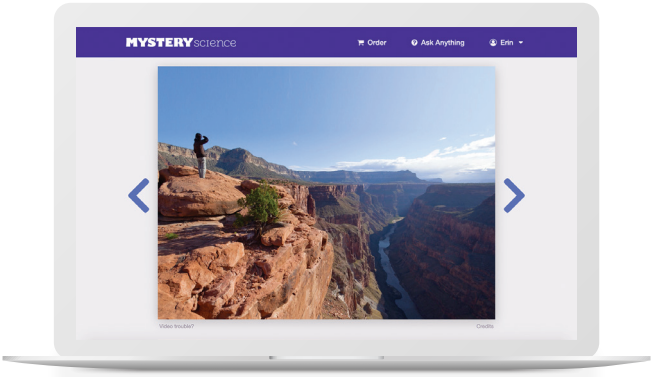
- 2-ESS1-1: Fast and Slow Earth Events
- 2-ESS2-1: Slowing the Erosion of Land Forms
- 2-ESS2-2: Landforms and Bodies of Water
- 2-ESS2-3: Water on Earth

Students figure out the unit phenomenon through the use of a variety of resources.

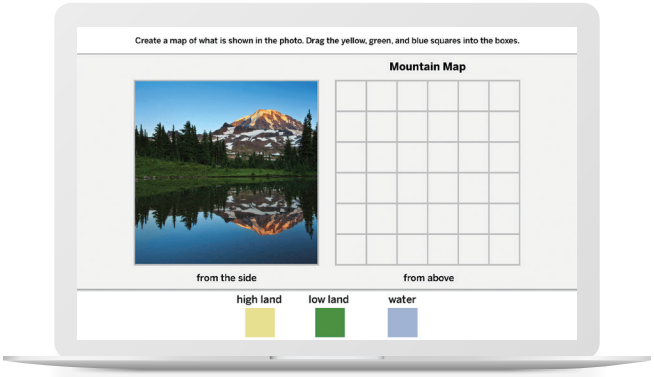
Student Books

Hands-On Kit

Videos



Practice tools



About technology in this unit:
Amplify Science California gives you the flexibility to use technology in the way that meets your needs best. In K–2, teachers have the option of using:

- **Student digital licenses** that allow for online completion of work, teacher feedback and grading, and digital class management.
- **Traditional consumable resources** that allow for a more familiar paper and pencil experience.

Whether students use the student digital experience or print workbooks, there are some technology-based activities all students will experience from time to time.

In grade 2, technology-based activities are limited to Practice Tools. In this particular unit, only 3 of the 22 lessons incorporate the use of devices with only 4% of the unit's activities involving the use of a digital tool.

When the use of a digital tool is called for in a lesson, teachers have several implementation options:

- **If limited student devices are available,** students can do activities in pairs or small groups.
- **If no student devices are available,** teachers can project the digital tool to the class and create a whole class experience.

Chapter 1:
The storyline begins

What students investigate:

How did the edge of the cliff get to be so close to the flagpole?

What they figure out:

The shape of the cliff changed when the rock it is made of changed.

How they figure it out:

- Gathering evidence that landforms are made of rock by observing photos
- Investigating sand samples and see that sand is composed of tiny pieces of rock
- Visualizing how grains of sand can form and how landforms can change size and shape using a model where they shake pieces of hard candy
- Learning about scientists who makes inferences about the rock that sand originates from based on its size, shape, and color as they read the student book *Handbook of Land and Water*

KEY


CLASS


HANDS-ON


MODELING


READING


STUDENT-TO-STUDENT DISCUSSION


TEACHER-LED DISCUSSION


WRITING

DAY 1 | LESSON 1.1

Pre-Unit Assessment

- Introducing the Unit (15 min)
- Writing Initial Explanations (20 min)
- Partner Reading (25 min)

Pre-Unit Assessment

DAY 2 | LESSON 1.2

Observations About Landforms

- Activating Prior Knowledge About Landforms (15 min)
- Previewing *Handbook of Land and Water* (10 min)
- Gathering Evidence from the Book (20 min)
- Reflecting on Landforms (15 min)

DAY 3 | LESSON 1.3

Observing Sand Samples

- Exploring Sand Samples (20 min)
- Comparing Sand Samples (30 min)
- Making Sand Sample Cards (10 min)

DAY 4 | LESSON 1.4

Gary's Sand Journal

- Setting a Purpose for Reading (15 min)
- Partner Reading (25 min)
- Making Observations of Mystery Sand (20 min)

On-the-Fly Assessment

DAY 5 | LESSON 1.5

Making Sense of Sand Samples

- Observing Sand Samples (20 min)
- Writing About Sand Samples (25 min)
- Sharing Sand Samples (15 min)

On-the-Fly Assessment

DAY 6 | LESSON 1.6

Explaining Landform Changes

- Gathering Evidence from a Hard Candy Model (20 min)
- Considering the Cliff (10 min)
- Writing a Scientific Explanation (30 min)

Critical Juncture Assessment
Self-Assessment

Chapter 2:
The storyline builds

What students investigate:

How did the recreation center's cliff change?

What they figure out:

Water hit the cliff and caused tiny pieces of the cliff to break off and move away.

How they figure it out:

- Investigating the process by which landforms change
- Observing images of landforms before and after big changes and discussing ideas about what might have caused the change to each landform
- Identifying water as an agent of change and using models with chalk to investigate how water can change a landform
- Exploring how water—in both liquid and solid form—can erode landforms by causing pieces of rock to break off as they read the student book *What's Stronger? How Water Causes Erosion*
- Diagramming this erosion process

KEY


CLASS


HANDS-ON


MODELING


READING


STUDENT-TO-STUDENT DISCUSSION


TEACHER-LED DISCUSSION


WRITING

DAY 7 | LESSON 2.1

Explaining Landform Changes

- Returning to the Cliff (10 min)
- Diagramming Landform Changes (20 min)
- Observing Landform Changes (30 min)

DAY 8 | LESSON 2.2

Modeling Landform Changes

- Considering How Water Changes Landforms (10 min)
- Modeling Landform Changes (35 min)
- Discussing Evidence (15 min)

On-the-Fly Assessment

DAY 9 | LESSON 2.3

What's Stronger? How Water Causes Erosion

- Previewing *What's Stronger? How Water Causes Erosion* (15 min)
- Partner Reading (30 min)
- Discussing Water (15 min)

On-the-Fly Assessment

DAY 10 | LESSON 2.4

Diagramming How a Landform Erodes

- Rereading *What's Stronger? How Water Causes Erosion* (30 min)
- Sharing Diagrams (15 min)
- Reflecting on Water Changing Landforms (15 min)

On-the-Fly Assessment

DAY 11 | LESSON 2.5

Scale of Erosion

- Scale of Erosion in the Chalk Model (25 min)
- Investigating Pumice Rock (20 min)
- Making Sense of How Landforms Erode (15 min)

On-the-Fly Assessment

DAY 12 | LESSON 2.6

Explaining How the Cliff Changed

- Building on Ideas (15 min)
- Diagramming the Cliff (15 min)
- Writing a Scientific Explanation (25 min)

Critial Juncture Assessment
Self-Assessment

Chapter 3:
The storyline goes deeper

What students investigate:

How did the recreation center's cliff erode without the director noticing?

What they figure out:

Because the pieces are so small, it took a really long time to observe a big change to the cliff.

How they figure it out:

- Studying and discussing maps
- Exploring landforms from different perspectives
- Creating maps of landforms using the Modeling Tool
- Eroding a model made of pom-poms (that represents a mountain) to show how many small changes (difficult to notice) can add up to a bigger change (easy to notice)
- Learning about slow changes to landforms and bodies of water as they read the student book *Handbook of Land and Water*
- Considering the scale of time and concluding that perceptible changes to landforms usually take a very long time
- Creating diagrams and writing explanations that explain how the recreation center's cliff eroded without the director noticing

KEY


CLASS


HANDS-ON


MODELING


READING


STUDENT-TO-STUDENT DISCUSSION


TEACHER-LED DISCUSSION


WRITING

DAY 13 | LESSON 3.1

Introduction to Maps

- Introducing Maps (5 min)
- Maps and *Handbook of Land and Water* (20 min)
- Visualizing Landforms from Above (10 min)
- Creating Digital Maps (25 min)

DAY 14 | LESSON 3.2

Investigating Differences in Scale

- Mapping the Mountain (20 min)
- Eroding the Mountain (30 min)
- Considering Scale in the Mountain Maps (10 min)

On-the-Fly Assessment

DAY 15 | LESSON 3.3

Accumulation of Small Changes

- Reading About Changes Over Time (30 min)
- Writing About Change (10 min)
- Sorting Erosion Cards (20 min)

On-the-Fly Assessment

DAY 16 | LESSON 3.4

Landform Change Over Time

- Observing Landform Changes on Maps (25 min)
- Modeling Changes Over Time (20 min)
- Reflecting on Scale (15 min)

Critical Juncture Assessment

DAY 17 | LESSON 3.5

End-of-Unit Assessment Part 1

- Making Sense of Landform Change Over Time (15 min)
- Writing Scientific Explanations (20 min)
- Diagramming Cliff Erosion (20 min)

End-of-Unit Assessment Part 1 Self-Assessment

Chapter 4:
Application to a new context

What students investigate:

Could the recreation center's cliff erode quickly?

What they figure out:

The nearby cliff eroded quickly because it is made of loose materials, such as clay and dirt, which are not as strong as rock. When wind or water hit the cliff, big pieces broke off. This caused the cliff to change more quickly than rock would.

How they figure it out:

- Brainstorming and creating diagrams of ways that landforms can erode quickly
- Exploring how landforms with cracks and those made of loose materials can erode faster than landforms made of solid rock as they read the student book *Handbook of Land and Water*
- Learning about what scientists consider when creating a stream model as they read the student book *Making Models of Streams*
- Using multiple erosion models to provide evidence that supports the idea that wind and water can quickly erode landforms made of loose materials
- Investigating why landforms made of different materials erode at different rates using the Modeling Tool
- Using newly discovered evidence and key ideas to diagram and write a final explanation of why the nearby cliff eroded overnight

KEY


CLASS


HANDS-ON


MODELING


READING


STUDENT-TO-STUDENT DISCUSSION


TEACHER-LED DISCUSSION


WRITING

DAY 18 | LESSON 4.1

Exploring How Landforms Erode Quickly

- How Landforms Erode Quickly Anticipatory Chart (15 min)
- Diagramming the Nearby Cliff (10 min)
- Reading About How Landforms Erode Quickly (25 min)
- Discussing Landforms That Erode Quickly (10 min)

On-the-Fly Assessment

DAY 19 | LESSON 4.2

Modeling How Landforms Erode Quickly

- Comparing Models (10 min)
- Modeling Erosion (25 min)
- Modeling How Wind Erodes Landforms (20 min)

DAY 20 | LESSON 4.3

Making Models of Streams

- Introducing *Making Models of Streams* (10 min)
- Partner Reading (30 min)
- Reflecting on Models (20 min)

On-the-Fly Assessment

DAY 21 | LESSON 4.4

Making Sense of How Landforms Erode Quickly

- Making Sense of How Landforms Erode Quickly (15 min)
- Modeling Loose Material and Rock (20 min)
- Building on Ideas (25 min)

On-the-Fly Assessment

DAY 22 | LESSON 4.5

End-of-Unit Assessment Part 2

- Evaluating the Use of Evidence in Diagrams (15 min)
- Diagramming How the Nearby Cliff Eroded (15 min)
- Writing Scientific Explanations (20 min)
- Preventing Erosion (10 min)

End-of-Unit Assessment Part 2

All students. All standards.

Rather than treating the standards simply as a list of topics to cover, we designed Amplify Science California to allow for truly in-depth and integrated coverage of the disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). Unlike other programs, however, ours makes the NGSS' vision of "all students, all standards" a reality by creating a unit-specific learning progression for every unit called a Progress Build.

Each Progress Build defines several levels of understanding of the unit's anchoring phenomenon, with each level integrating and building upon the knowledge and skills from lower levels. In this way, each Progress Build provides a clear roadmap for how students' understanding of the phenomenon is expected to deepen and develop with each successive chapter and lesson.

What's more, the program's system of assessments is also tied to these Progress Builds. This carefully crafted integration provides teachers with credible, actionable, and timely diagnostic information about student progress toward the unit's learning goals and grade-level performance expectations. Armed with this powerful data, teachers have the ultimate flexibility to decide when to move on and when to slow down and dive deeper.

Changing Landforms Progress Build

The Progress Build in this unit consists of three levels of understanding. At each level, students add new ideas and integrate them into a progressively deeper understanding of how landforms change and how quickly those changes take place.

Progress Build Level 3:

Landforms change slowly.

Progress Build Level 2:

Water can cause landforms to change.

Progress Build Level 1:

Landforms can change.

Examples of differentiation in this unit

In addition to providing unit-specific Progress Builds that break learning goals into smaller, more achievable levels of understanding, Amplify Science California makes learning accessible for all students through a variety of scaffolds, supports, and differentiation strategies for every lesson. **For a complete list of strategies, see the Differentiation section of every Lesson Brief**.

Below are a few examples of strategies embedded in this unit.

For English learners:

Previewing temporal words (Example from Lesson 2.1)
In this unit, students are often asked to describe what happened to something in the time between the past and the present. For example, in this lesson students describe what they think happened to water that disappeared from a cup that used to be full of water. Some students could benefit from a preview of temporal words including: first, then, finally, and eventually. This can help students recognize and use these words in context.

For students needing more support:

Provide visual cues (Example from Lesson 1.3)
This lesson has a number of steps that students need to follow in order to be successful in their investigations. To help diverse learners keep track of the expectations, you may want to provide more than just the oral and projected directions. For example, you could use visual aids, such as holding up the sand samples or creating a Sand Sample Card, as you explain the procedures.

For students ready for a challenge:

Visual representations (Example from Lesson 3.4)
Consider asking students who need more challenge to predict what Rocky Shore Island will look like in the future. Have students draw what the island will look like 5 years from now, 100 years from now, and thousands of years from now. You could provide students with tracing paper to make it easier for them to reproduce the shape of the island in Map D. Then direct them to show how they think the shape of the island would change. Ask students to label each drawing with the number of years that have elapsed (for example, "100 years from now").

3-D Statements

In order to help teachers recognize the three-dimensional structure of every unit, chapter, and lesson, each unit contains a 3-D Statement document that makes the integration clear.

Making the 3-D statement document all the more effective, the three dimensions are color-coded for easy recognition.

Changing Landforms 3-D Coverage

SEPs
Science and Engineering Practices

DCIs
Disciplinary Core Ideas

CCCs
Cross-Cutting Concepts

Unit Level

Students use models to investigate how wind and water cause changes to landforms (cause and effect). They figure out that erosion causes small changes to landforms, which add up to big changes over long periods of time and that landforms made of loose materials can erode much more quickly (scale, proportion, and quantity; stability and change). Throughout the unit, students create diagram models and write explanations to show their developing understanding.

Chapter Level

Chapter 1: How did the edge of the cliff get to be so close to the flagpole?

Students obtain and evaluate information about what landforms are made of—rock. They then investigate sand samples and use a physical model to begin constructing understanding about how geologists study changes they cannot observe directly, such as how rock can change even though it is hard (stability and change).

Chapter 2: How did the recreation center's cliff change?

Students use a physical model and obtain and evaluate information from a book to figure out how water changes landforms through the process of erosion, breaking off small pieces of rock (stability and change). Students draw diagram models and write explanations about how erosion caused the recreation center's cliff to change (cause and effect).

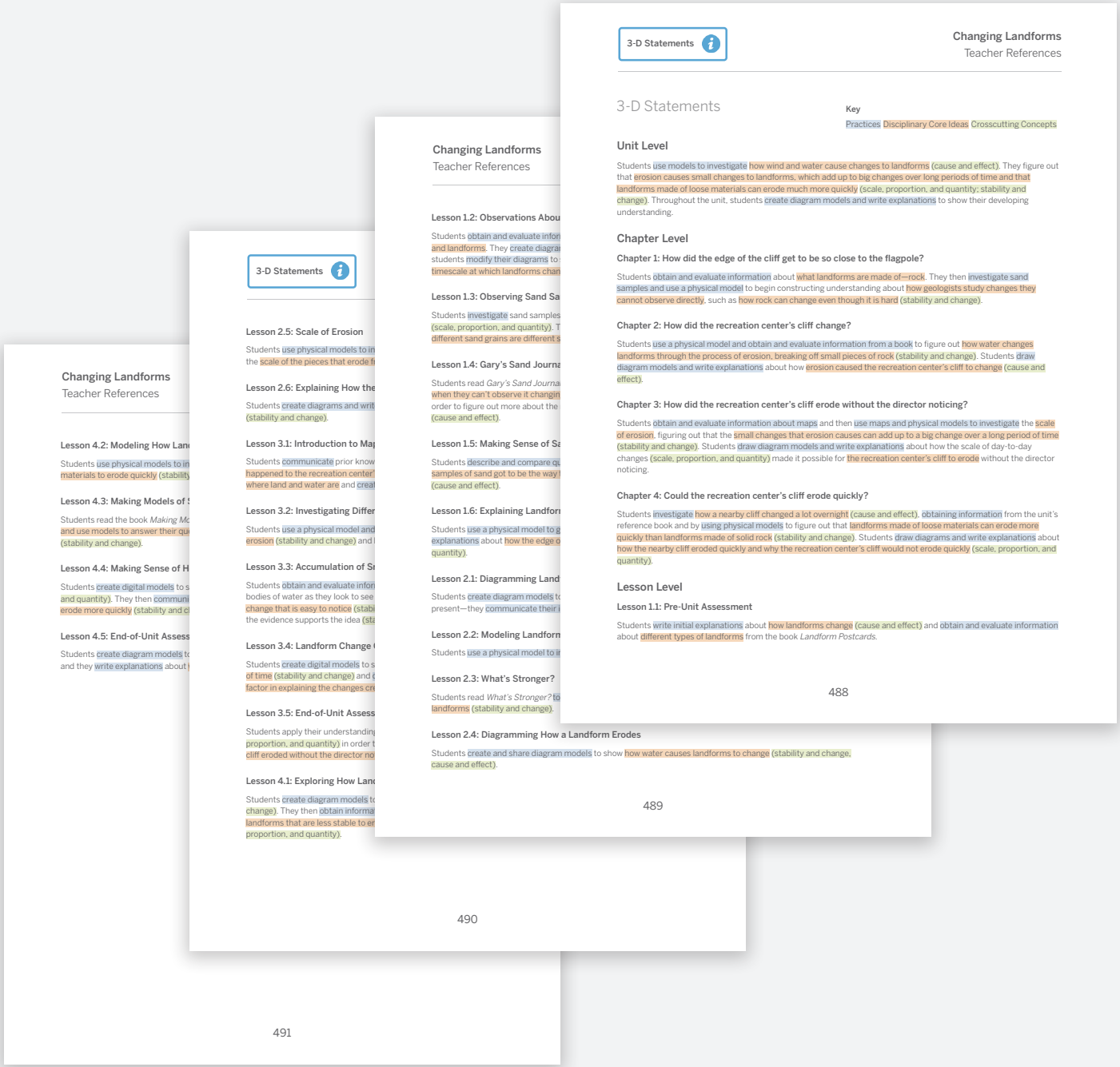
Chapter 3: How did the recreation center's cliff erode without the director noticing?

Students obtain and evaluate information about maps and then use maps and physical models to investigate the scale of erosion, figuring out that the small changes that erosion causes can add up to a big change over a long period of time (stability and change). Students draw diagram models and write explanations about how the scale of day-to-day changes (scale, proportion, and quantity) made it possible for the recreation center's cliff to erode without the director noticing.

Chapter 4: Could the recreation center's cliff erode quickly?

Students investigate how a nearby cliff changed a lot overnight (cause and effect), obtaining information from the unit's reference book and by using physical models to figure out that landforms made of loose materials can erode more quickly than landforms made of solid rock (stability and change). Students draw diagrams and write explanations about how the nearby cliff eroded quickly and why the recreation center's cliff would not erode quickly (scale, proportion, and quantity).

To review the 3-D Statements at the lesson level, see the Lesson Brief section of every lesson.



3-D Statements

Changing Landforms
Teacher References

3-D Statements

Key
Practices Disciplinary Core Ideas Crosscutting Concepts

Unit Level

Students use models to investigate how wind and water cause changes to landforms (cause and effect). They figure out that erosion causes small changes to landforms, which add up to big changes over long periods of time and that landforms made of loose materials can erode much more quickly (scale, proportion, and quantity; stability and change). Throughout the unit, students create diagram models and write explanations to show their developing understanding.

Chapter Level

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Chapter 2: How did the recreation center's cliff change?

Students use a physical model and obtain and evaluate information from a book to figure out how water changes landforms through the process of erosion, breaking off small pieces of rock (stability and change). Students draw diagram models and write explanations about how erosion caused the recreation center's cliff to change (cause and effect).

Chapter 3: How did the recreation center's cliff erode without the director noticing?

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Chapter 4: Could the recreation center's cliff erode quickly?

Students investigate how a nearby cliff changed a lot overnight (cause and effect), obtaining information from the unit's reference book and by using physical models to figure out that landforms made of loose materials can erode more quickly than landforms made of solid rock (stability and change). Students draw diagrams and write explanations about how the nearby cliff eroded quickly and why the recreation center's cliff would not erode quickly (scale, proportion, and quantity).

Lesson Level

Lesson 1.1: Pre-Unit Assessment

Students write initial explanations about how landforms change (cause and effect) and obtain and evaluate information about different types of landforms from the book *Landform Postcards*.

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Changing Landforms
Teacher References

Lesson 1.2: Observations Abou

Students obtain and evaluate infor
and landforms. They create diagra
students modify their diagrams to
timescale at which landforms chan

Lesson 1.3: Observing Sand Sa

Students investigate sand samples
(scale, proportion, and quantity). T
different sand grains are different s

Lesson 1.4: Gary's Sand Journa

Students read *Gary's Sand Journa*
when they can't observe it changin
order to figure out more about the
(cause and effect).

Lesson 1.5: Making Sense of Sa

Students describe and compare qu
samples of sand got to be the way
(cause and effect).

Lesson 1.6: Explaining Landfor

Students use a physical model to g
explanations about how the edge o
quantity).

Lesson 2.1: Diagramming Land

Students create diagram models to
present—they communicate their i

Lesson 2.2: Modeling Landform

Students use a physical model to i

Lesson 2.3: What's Stronger?

Students read *What's Stronger?* to
landforms (stability and change).

Lesson 2.4: Diagramming How a Landform Erodes

Students create and share diagram models to show how water causes landforms to change (stability and change, cause and effect).

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3-D Statements

Lesson 2.5: Scale of Erosion

Students use physical models to in
the scale of the pieces that erode fr

Lesson 2.6: Explaining How the

Students create diagrams and writ
(stability and change).

Lesson 3.1: Introduction to Map

Students communicate prior know
happened to the recreation center
where land and water are and creat

Lesson 3.2: Investigating Differ

Students use a physical model and
erosion (stability and change) and

Lesson 3.3: Accumulation of Sa

Students obtain and evaluate infor
bodies of water as they look to see
change that is easy to notice (stabi
the evidence supports the idea (sta

Lesson 3.4: Landform Change

Students create digital models to s
of time (stability and change) and
factor in explaining the changes cr

Lesson 3.5: End-of-Unit Assess

Students apply their understanding
proportion, and quantity) in order t
cliff eroded without the director no

Lesson 4.1: Exploring How Land

Students create diagram models to
change). They then obtain informa
landforms that are less stable to er
proportion, and quantity).

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Changing Landforms
Teacher References

Lesson 4.2: Modeling How Land

Students use physical models to in
materials to erode quickly (stability

Lesson 4.3: Making Models of S

Students read the book *Making Mo*
and use models to answer their qu
(stability and change).

Lesson 4.4: Making Sense of H

Students create digital models to s
and quantity). They then communi
erode more quickly (stability and c

Lesson 4.5: End-of-Unit Assess

Students create diagram models to
and they write explanations about

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Notes

Notes

For more information on Amplify Science, visit **amplify.com/science/california**.

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